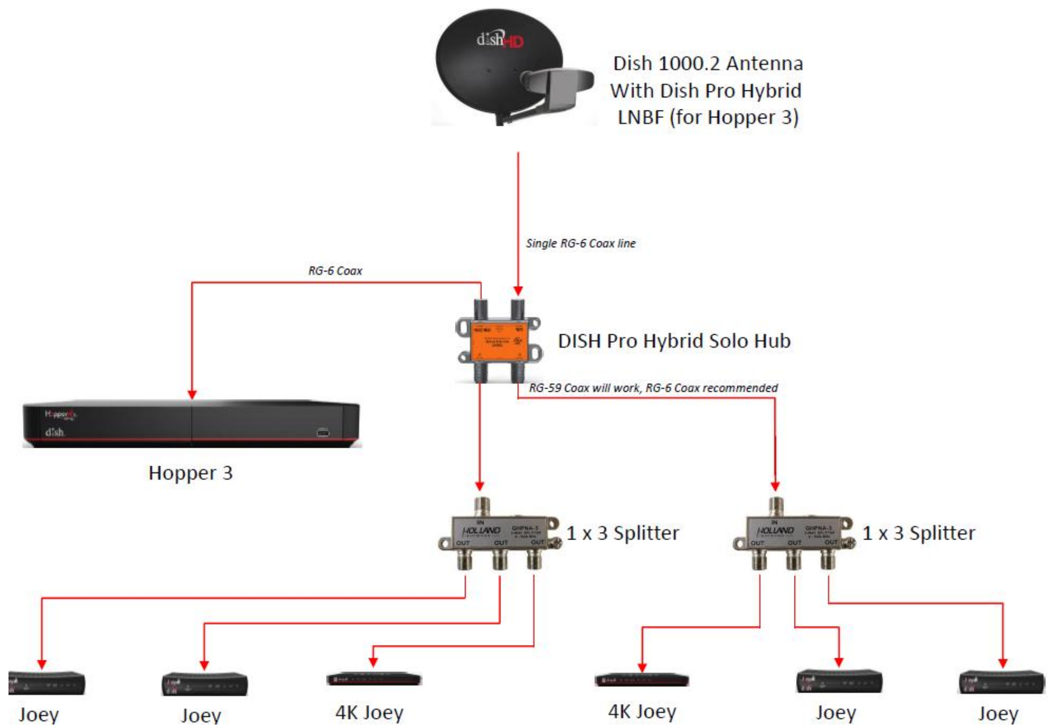
EXHIBIT F

U.S. Patent No. 7,889,759 ("the '759 Patent") Exemplary Infringement Chart

The Accused MoCA Instrumentalities are instrumentalities that DISH deploys to provide a whole-premises DVR network over an on-premises coaxial cable network, with DISH "Hopper" and "Joey" nodes operating with data connections compliant with MoCA 1.0, 1.1, and/or 2.0. The Accused MoCA Instrumentalities include the DISH Hopper, DISH Hopper with Sling, DISH Hopper DUO, DISH Joey, DISH Joey 2, and DISH Super Joey, DISH Hopper 3, DISH 4K Joey, and DISH Joey 3, and substantially similar instrumentalities. DISH literally and/or under the doctrine of equivalents infringes the claims of the '759 Patent under 35 U.S.C. § 271(a) by using the Accused MoCA Instrumentalities.

U.S. Patent No. 7,889,759	The Accused MoCA Instrumentalities Form a Network That Practices at Least Claim 2 of the '759 Patent
2. A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:	The Accused Services are provided using at least the Accused MoCA Instrumentalities including the DISH Hopper, DISH Hopper with Sling, DISH Hopper DUO, DISH Joey, DISH Joey 2, DISH Super Joey, DISH Hopper 3, DISH 4K Joey, and DISH Joey 3, and devices that operate in a similar manner. The Accused MoCA Instrumentalities operate to perform method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN") as described below. The DISH full-premises DVR network constitutes a broadband cable network as claimed. The DISH full-premises DVR network is a MoCA network created between at least one Hopper DVR and one or more Joey receivers using the on-premises coaxial cable network. This MoCA network is compliant with MoCA 1.0, 1.1, and/or 2.0. "The MoCA system network model creates a coax network which supports communications between a convergence layer in one MoCA node to the corresponding convergence layer in another MoCA node." (MoCA 1.0, Section 1. See also MoCA 1.1, Section 1.1; MoCA 2.0, Section 1.2.2)

	"The MoCA Network transmits high speed multimedia data over the in-home coaxial cable infrastructure." (MoCA 1.0, Section 2. See also MoCA 1.1, Section 2; MoCA 2.0, Section 5) "Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node. A single MoCA Network must support communications of 2 to 8 MoCA nodes. Each MoCA node must support point-to-point and broadcast modulation profiles with all other MoCA nodes." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1) DISH utilizes the MoCA standard to provide an on-premises DVR network over an on-premises coaxial cable network as described below:



DISH PRO HYBRID SOLO HUB: This Solo Hub is a home video network device that combines multi-orbital coaxial cable satellite feeds from a DISH 1000.2 antenna or switch into a single-cable coaxial satellite feed to support MoCA networking for the Hopper 3 DVRs (host). The client ports are intended to feed up to 6 Joey client receivers (clients). The Solo Hub creates a MoCA video network for Hopper DVRs and Joeys. Rated 50 MHz to 3 GHz.

SPLITTERS: 1 GHz common splitters can be used to feed Joey client receivers.

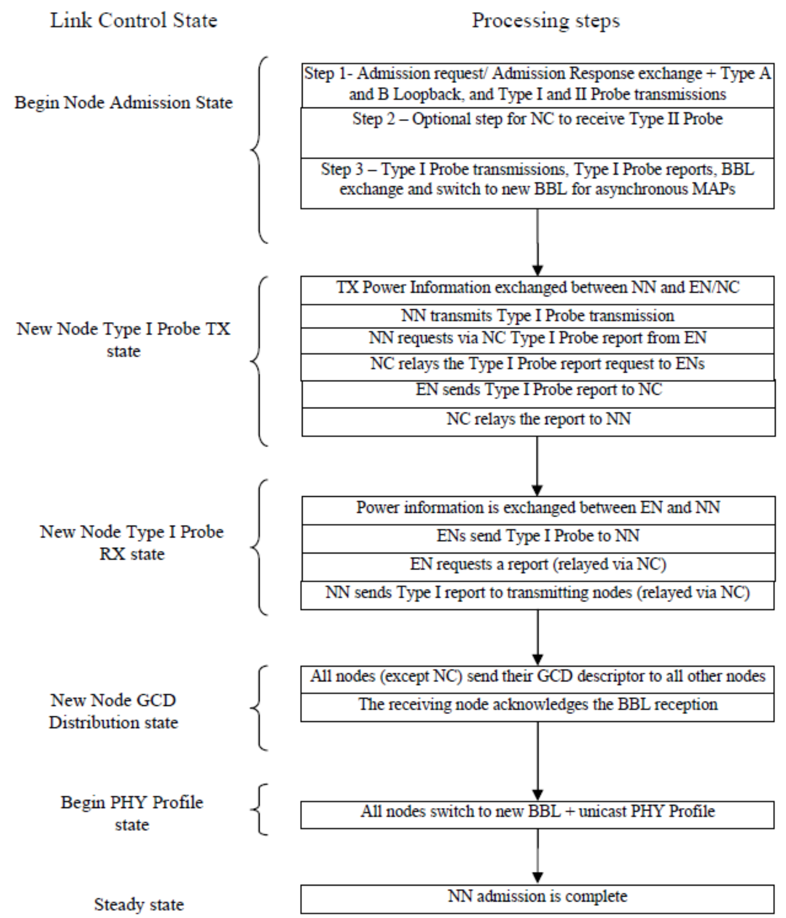
HOPPER 3: The Hopper 3 is the revolutionary whole-home DVR from DISH that includes 16 satellite tuners and a 2TB hard drive.

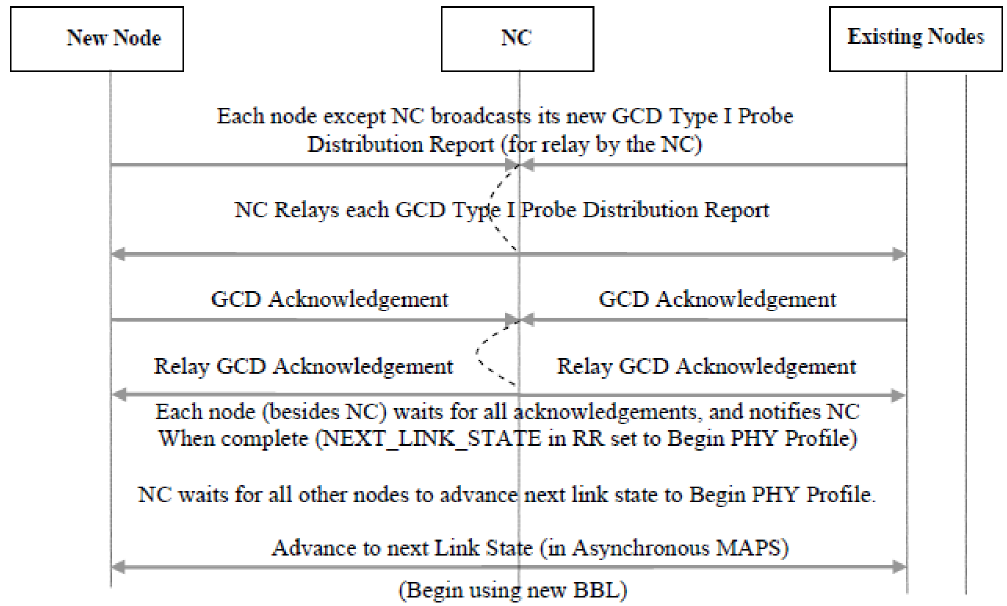
	JOEY: The Joey is the MoCA thin-client receiver that networks with the Hopper for viewing on additional TVs. 4K JOEY: The 4K Joey is an option for installation on additional 4K TVs. DISH PRO HYBRID 42 SWITCH: This switch allows two Hopper 3 DVRs to be installed using a single DISH traditional 1000.2 antenna. Each Hopper 3 forms its own MoCA video network with connected Joeys. The switch comes with a 110VAC power supply unit. Your new Hopper® 3 receiver is a Whole-Home HD DVR that offers full digital video recording functionality, including pausing live TV, to every TV in your house that is part of your Whole-Home DVR system. The Hopper 3 receiver is the hub for all things entertainment. It is an HD DVR that provides the equivalent of 16 tuners, allowing you to record multiple HD channels at once and at any time and play them back in any room in your home. Using the PrimeTime Anytime® feature, you can record up to six HD channels simultaneously (with your local ABC, CBS, FOX and NBC channels provided in HD, which may not be available in all markets). It is one HD DVR that works independently on as many as four different TVs at the same time, so everyone can be in different room watching their favorite TV programming. Joey® receivers (Joey®, SuperJoey®, Wireless Joey®, 4K Joey™) connect to other TVs in your home and link to the Hopper 3 system, creating a Whole-Home DVR network. It supports all of the features of the Hopper 3 (with the exception of Picture-In-Picture) and offers an identical user interface as the Hopper 3. You can connect a Joey receiver to a high-definition or standard-definition TV.

	CONNECTING THE JOEY RECEIVER(S) This section describes how to connect the receiver's **HOME VIDEO NETWORK** connection to one or more cable-ready remote TV(s) located in other room(s) away from the Hopper. You can use these instructions to connect TVs in your home to see live and recorded programming from the Hopper. This installation uses your in-home coaxial cable system. If your home does not have built-in cabling, it will be necessary to run these cables from the Hopper HD DVR to each Joey Receiver conected to a remote TV. Due to the potential complexity of this installation, you should have this professionally installed. Call the DISH Customer Service Center at 1-800-333-DISH (3474) for more information. If you need another remote control, be sure to order the replacement remote control kit for Hopper and Joey that uses UHF-2G signals. Call your DISH retailer, or visit www.mydish.com online, select Upgrades, then Products, and click on Remote & Accessories. 1 Connect the **HOME VIDEO NETWORK** output on the back of the Hopper HD DVR to an existing wall cable outlet using a coaxial cable. 2 Connect the Joey Receiver(s) in other room(s) to existing wall cable outlet(s) using coaxial cable(s). 3 Connect the Joey Receiver(s) to an audio/video input of the remote TV in each room. • If it is a high-definition TV or monitor and an HDMI connection is available on the remote TV, use a single HDMI cable from the output on the back of the Joey Receiver to provide high-quality audio and HD/SD video. See page 94. • If it is a standard-definition TV or an HDMI connection is not available on the remote TV, use composite (yellow) video and stereo audio cables from the outputs on the back of the Joey Receiver. See page 95. 4 Turn on every Joey Receiver and remote TV connected to the in-home cabling system. If you have not already done so, you may need to pair a remote control to each Joey. 5 Follow the on-screen prompts or included instructions for linking each Joey Receiver to your Hopper HD DVR. (The Hopper is the host for DISH Whole-Home DVR services.) 6 Confirm that you see a picture from your Joey Receiver(s) on your remote TV(s). • If your picture looks good, then you are finished with this procedure. • If your TVs do not display a picture or if the picture is not as clear as you would like it to be, repeat the steps to confirm all the connections. Coaxial connections should be hand-tightened.
transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-	The Accused MoCA Instrumentalities operate to transmit a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes as described below.

plurality of receiving nodes within the plurality of nodes;	For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that transmit a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes. "While it is physically a shared medium, the logical network model is a fully meshed collection of point-to-point links, each with its own unique channel characteristics and channel capacity. MoCA devices use optimized PHY parameters between every point to point link. Each set of optimized PHY parameters is called a PHY Profile. Because each link is unique, it is critical that all nodes know the source and the destination for every transmission." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2; MoCA 2.0, Section 1.2.2) "The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2) "ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable

	bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is "modulation profile" and the process of creating a modulation profile between a node pair is called "modulation profiling". During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link throughput while maintaining a low packet error rate." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5) "A variety of physical layer frequency-domain and time-domain probes are used to create modulation profiles, optimize performance, and allow for various calibration mechanisms. Type I Modulation Profile Probes are frequency domain probes used to determine modulation profiles of the channel between any two nodes. Type II Probes are frequency domain probes consisting of two tones that may be used to fine tune performance. A Type III Echo Profile Probe may be used to determine the impulse response of the channel. This information can be used to optimize various physical layer parameters. In addition to the above probes, this specification provides opportunities for various unique Loopback Transmissions which may be useful for RF calibration, among other things." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)

	 **Figure 3-4. Flowchart of the Steps Involved in Admitting a Node to the Network** (MoCA 1.0, Figure 3-4. *See also* MoCA 1.1, Figure 3-6; MoCA 2.0, Figure 8-3) "When an EN receives Type I Probe Report, it MUST begin reporting New Node GCD Distribution state to the NC. The NN MUST begin reporting New Node GCD Distribution state in its reservation requests (byte code 0x04 NEXT_LINK_STATE field) after it sends the Type I Probe Report for all nodes

	in the network." (MoCA 1.0, Section 3.6.6. *See also* MoCA 1.1, Section 3.6.6, MoCA 2.0, Section 8.3.7)  **Figure 3-10. Messages Exchanged during the New Node GCD Distribution State** (MoCA 1.0, Figure 3-10. *See also* MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11) "GCD PHY Profile Transmission from NN and ENs: This message is sent by each node, except NC, to all other nodes (including NC). This report is sent in the form of a Type I Probe Report (Section 3.6.3.2) with RELAY_FLAG = 1 for NC to relay the report to the rest of the nodes in the network. The report informs receiving nodes of the PHY profile that the node wishes to use for broadcast

	messages and asynchronous MAPs (if the node becomes NC).” (MoCA 1.0, Section 3.6.6.1. *See also* MoCA 1.1, Section 3.6.6.1, MoCA 2.0, Section 8.3.7)
receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;	The Accused MoCA Instrumentalities operate to receive a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that receive a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node.

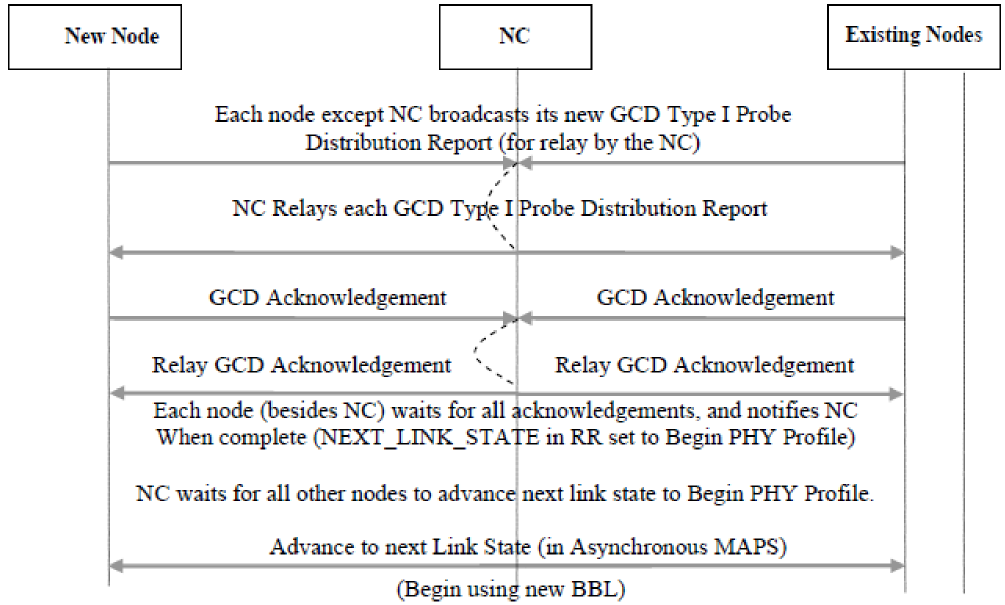


Figure 3-10. Messages Exchanged during the New Node GCD Distribution State

(MoCA 1.0, Figure 3-10. *See also* MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11)

"Following the Type I Probe Report from the NN and ENs, the NC MUST relay the report to the other nodes in the network. The NC MUST NOT change the Type I Probe Report payload when relaying the information." (MoCA 1.0, Section 3.6.6.2. *See also* MoCA 1.1, Section 3.6.6.2, MoCA 2.0, Section 8.3.7)

"Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting "Begin PHY Profile" state in its reservation request after it has received the acknowledgments and GCD Distribution reports from all other nodes."

	(MoCA 1.0, Section 3.6.6.3. *See also* MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7) “Once each node begins to send “Begin PHY Profile” state in its reservation request the NC MUST advance the Link Control state to Begin PHY Profile state. When EN’s and NN receive this Link Control state indication, they can begin using newly computed PHY profiles (including transmit power settings) as described in Section 3.13.3.” (MoCA 1.0, Section 3.6.7. *See also* MoCA 1.1, Section 3.6.7, MoCA 2.0, Section 8.3.9) “The Type I Probe Report conveys critical information about channel conditions such as Modulation Profile and Power Control. The calculated parameters of this report are derived from Type I and optionally from Type III Probes and are described in Table 3-27. These parameters are to be used in future transmissions to the node that sent the report.” (MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Section 8.3.4.1.7)

	Table 3-27. Type I Probe Report Calculated Parameters PREAMBLE_TYPE: Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.

Table 3-27. Type I Probe Report Calculated Parameters

Parameter	Explanation
PREAMBLE_TYPE	Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.
BITS_PER_ACMT_SYMBOL	The total number of bits per ACMT symbol, calculated from the Modulation Profile.
CHANNEL_USABLE	Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.
CP_LENGTH	Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.
TPC_BACKOFF_MAJOR	Outer Loop Power Control backoff
TPC_BACKOFF_MINOR	Outer Loop Power Control backoff
SC_MOD	Modulation Profile

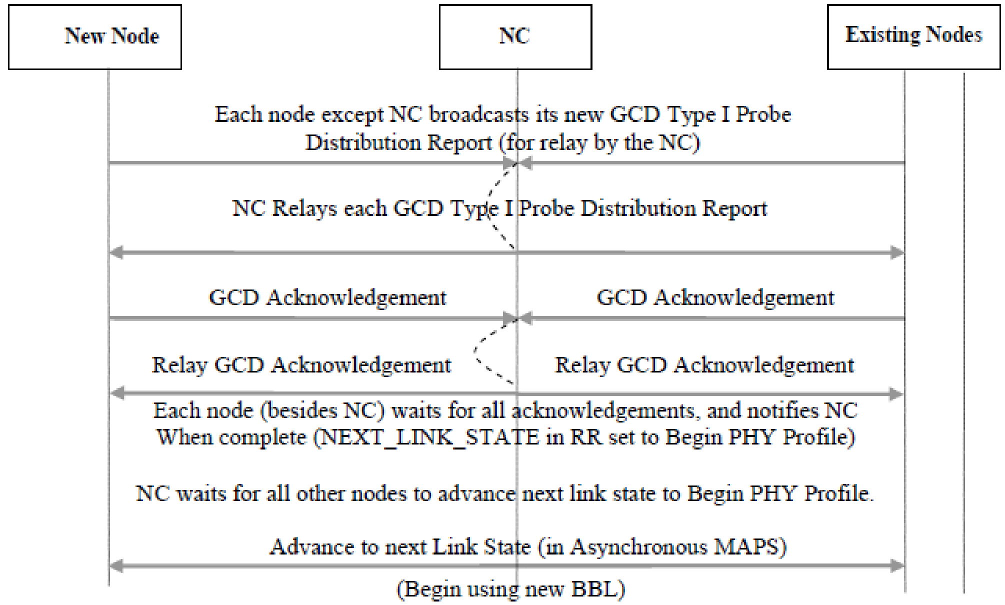
(MoCA 1.0, Table 3-27. *See also* MoCA 1.1, Table 3-33, MoCA 2.0, Table 6-32)

"The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by

	multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously." (MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)
determining the common bit-loading modulation scheme from the received plurality of response signals;	The Accused MoCA Instrumentalities operate to determine the common bit-loading modulation scheme from the received plurality of response signals as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the common bit-loading modulation scheme from the received plurality of response signals. "PHY Profile – A set of parameters that defines the modulation between two nodes, including the preamble type, Cyclic Prefix length, Modulation Profile, and transmit power." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "Greatest Common Density (GCD) - A modulation format computed by a node for transmission to multiple recipient nodes. For the GCD format, the modulation density used for each subcarrier is chosen to be the greatest possible constellation density that is less than or equal to the constellation density for that subcarrier as

	reported in the most recent Type I Probe Report the node sent to each of the other nodes in which the node indicated CHANNEL_USABLE = 0x01." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1) "A receiving node processes this [Type I: Modulation Profile Probe] to generate a modulation profile of QAM constellations. The modulation profile is transmitted back to the node that generated the probe so that the node knows which modulation profile to select when transmitting to that receiving node (for a description of PHY probe processing by the MAC see Section 3.13)." (MoCA 1.0, Section 4.5.1. *See also* MoCA 1.1, Section 4.5.1, MoCA 2.0, Section 8.3.4.1.10) "The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously."

	(MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)
receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;	The Accused MoCA Instrumentalities operate to receive the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that receive the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission. "While it is physically a shared medium, the logical network model is a fully meshed collection of point-to-point links, each with its own unique channel characteristics and channel capacity. MoCA devices use optimized PHY parameters between every point to point link. Each set of optimized PHY parameters is called a PHY Profile. Because each link is unique, it is critical that all nodes know the source and the destination for every transmission." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2; MoCA 2.0, Section 1.2.2)

	 **Figure 3-10. Messages Exchanged during the New Node GCD Distribution State** (MoCA 1.0, Figure 3-10. *See also* MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11) "Following the Type I Probe Report from the NN and ENs, the NC MUST relay the report to the other nodes in the network. The NC MUST NOT change the Type I Probe Report payload when relaying the information." (MoCA 1.0, Section 3.6.6.2. *See also* MoCA 1.1, Section 3.6.6.2, MoCA 2.0, Section 8.3.4.1.9) "Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting "Begin PHY Profile" state in its reservation request

	after it has received the acknowledgments and GCD Distribution reports from all other nodes." (MoCA 1.0, Section 3.6.6.3. *See also* MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.4.1.10) "The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2) "ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is "modulation profile" and the process of creating a modulation profile between a node pair is called "modulation profiling". During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link throughput while maintaining a low packet error rate." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5) "A variety of physical layer frequency-domain and time-domain probes are used to create modulation profiles, optimize performance, and allow for various

	calibration mechanisms. Type I Modulation Profile Probes are frequency domain probes used to determine modulation profiles of the channel between any two nodes. Type II Probes are frequency domain probes consisting of two tones that may be used to fine tune performance. A Type III Echo Profile Probe may be used to determine the impulse response of the channel. This information can be used to optimize various physical layer parameters. In addition to the above probes, this specification provides opportunities for various unique Loopback Transmissions which may be useful for RF calibration, among other things." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)
determining the transmission characteristics of the channel path at the one receiving node;	The Accused MoCA Instrumentalities operate to determine the transmission characteristics of the channel path at the one receiving node as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the transmission characteristics of the channel path at the one receiving node. "The logical network model is significantly different than the physical network. Because of the effects of splitter jumping and reflections, the channel characteristics for a link between two nodes may be dramatically different than a link between any other two nodes. Channel characteristics are also sensitive to the direction of the communication, so a reverse path may be different than the forward path." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 1.2.2)

	"In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node. (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1) "The PHY packets are categorized into two types as shown in Table 4-1. PHY data packets transport MAC data frames (e.g. containing application layer data and MoCA Network control data). PHY probe packets transport information used to characterize the communication medium and optimize physical layer performance." (MoCA 1.0, Section 4.2. *See also* MoCA 1.1, Section 4.2, MoCA 2.0, Section 14.2.2.1)
transmitting a response signal from the one receiving node to the transmitting node,	The Accused MoCA Instrumentalities operate to transmit a response signal from the one receiving node to the transmitting node as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that transmit a response signal from the one receiving node to the transmitting node. "Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting "Begin PHY Profile" state in its reservation request

	after it has received the acknowledgments and GCD Distribution reports from all other nodes." (MoCA 1.0, Section 3.6.6.3. *See also* MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7)
wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node and	The transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the transmission characteristics of the channel path by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node. "The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links." (MoCA 1.0, Section 2.2. *See also* MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2) "The Type I Probe Report conveys critical information about channel conditions such as Modulation Profile and Power Control. The calculated parameters of this report are derived from Type I and optionally from Type III Probes and are

described in Table 3-27. These parameters are to be used in future transmissions to the node that sent the report."

(MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Section 8.3.4.1.7)

Table 3-27. Type I Probe Report Calculated Parameters

Parameter	Explanation
PREAMBLE_TYPE	Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.
BITS_PER_ACMT_SYMBOL	The total number of bits per ACMT symbol, calculated from the Modulation Profile.
CHANNEL_USABLE	Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.
CP_LENGTH	Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.
TPC_BACKOFF_MAJOR	Outer Loop Power Control backoff
TPC_BACKOFF_MINOR	Outer Loop Power Control backoff
SC_MOD	Modulation Profile

(MoCA 1.0, Table 3-27. *See also* MoCA 1.1, Table 3-33, MoCA 2.0, Table 6-32)

	"The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously." (MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32) *See also* MoCA 1.0, Section 8; MoCA 1.1, Section 8, MoCA 2.0, Section 16. "Modulation Profiling – The process of optimizing the Modulation Profile of the ACMT signal to achieve a high data rate and low packet error rate for a node to node link." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "The MoCA physical layer (PHY) utilizes a modulation technique named Adaptive Constellation Multi-tone (ACMT). ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is "modulation profile" and the process of creating a modulation profile between a node pair is called "modulation profiling". During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link throughput while maintaining a low packet error rate (PER). For each active ACMT subcarrier, the QAM constellation can vary from 1 to 8 bits per symbol (BPSK through 256QAM). Individual subcarriers can also be turned off. As a result, the number of bits per ACMT symbol varies as a function of the channel path."

	(MoCA 1.0, Section 2.2. See also MoCA 1.1, Section 2.2; MoCA 2.0, Section 5) "Packet Error Rate (PER) – The ratio between (1) the total number of Ethernet packets with a destination address associated with the receiving Node received at the transmitting Node's ECL (total number of transmitted packets) minus the number of Ethernet packets received by the receiving Node from the transmitting Node and forwarded to its ECL with no CRC errors and (2) the total number of transmitted packets, when the total number of transmitted packets is at least 10,000,000" (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "The MoCA channel characteristics vary considerably between different existing coax home cabling as well as across different RF channels. Since the MoCA system adapts to the channel characteristics, if a MoCA Network is able to form in a coax network, the network MUST operate with a PER $\leq 10^{-5}$ as long as the delay spread is under 800 nanoseconds and external interference is not present. The PER is measured over a minimum of 10 million total packets." (MoCA 1.0, Section 8.1.1. *See also* MoCA 1.1, Section 8.1.1, MoCA 2.0, Section 16.3)
generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,	The Accused MoCA Instrumentalities operate to generate the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that generate the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path.

	"GCD PHY Profile Transmission from NN and ENs: This message is sent by each node, except NC, to all other nodes (including NC). This report is sent in the form of a Type I Probe Report (Section 3.6.3.2) with RELAY_FLAG = 1 for NC to relay the report to the rest of the nodes in the network. The report informs receiving nodes of the PHY profile that the node wishes to use for broadcast messages and asynchronous MAPs (if the node becomes NC)." (MoCA 1.0, Section 3.6.6.1. *See also* MoCA 1.1, Section 3.6.6.1, MoCA 2.0, Section 8.3.7) "Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting "Begin PHY Profile" state in its reservation request after it has received the acknowledgments and GCD Distribution reports from all other nodes." (MoCA 1.0, Section 3.6.6.3. *See also* MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7) "Once each node begins to send "Begin PHY Profile" state in its reservation request the NC MUST advance the Link Control state to Begin PHY Profile state. When EN's and NN receive this Link Control state indication, they can begin using newly computed PHY profiles (including transmit power settings) as described in Section 3.13.3." (MoCA 1.0, Section 3.6.7. *See also* MoCA 1.1, Section 3.6.7, MoCA 2.0, Section 8.3.9)
wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response	Determining a common bit-loading modulation scheme includes comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded

signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.	modulation schemes as described below. For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine a common bit-loading modulation scheme by at least comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes. "PHY Profile – A set of parameters that defines the modulation between two nodes, including the preamble type, Cyclic Prefix length, Modulation Profile, and transmit power." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3) "Greatest Common Density (GCD) - A modulation format computed by a node for transmission to multiple recipient nodes. For the GCD format, the modulation density used for each subcarrier is chosen to be the greatest possible constellation density that is less than or equal to the constellation density for that subcarrier as reported in the most recent Type I Probe Report the node sent to each of the other nodes in which the node indicated CHANNEL_USABLE = 0x01." (MoCA 1.0, Section 1.2. *See also* MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)

	"In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node." (MoCA 1.0, Section 2.1.2. *See also* MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1) "A receiving node processes this [Type I: Modulation Profile Probe] to generate a modulation profile of QAM constellations. The modulation profile is transmitted back to the node that generated the probe so that the node knows which modulation profile to select when transmitting to that receiving node (for a description of PHY probe processing by the MAC see Section 3.13)." (MoCA 1.0, Section 4.5.1. *See also* MoCA 1.1, Section 4.5.1, MoCA 2.0, Section 8.3.4.1.10) "The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously." (MoCA 1.0, Section 3.13.3.1. *See also* MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)